

NOISE ELEMENT

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City planning

Foster City

Noise abatement



FOSTER CITY PLANNING DEPARTMENT

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RESOLUTION NO. P-1-76

A RESOLUTION OF THE FOSTER CITY PLANNING COMMISSION AMENDING THE FOSTER CITY GENERAL PLAN BY ADOPTING AND ENDORSING THE NOISE ELEMENT AS A PART OF SAID PLAN

CITY OF FOSTER CITY PLANNING COMMISSION

BE IT RESOLVED BY THE CITY OF FOSTER CITY PLANNING COMMISSION, as follows:

WHEREAS, said Noise Element was heard after notice duly given before this Commission on October 16, 1975, continued to November 6, 1975, continued to November 20, 1975, continued to November 21, 1975, continued to December 4, 1975, continued to December 18, 1975, and continued to January 8, 1976, at which time all persons interested were given the opportunity to be heard; and

WHEREAS, this Commission has given due consideration of said Element as presented.

NOW, THEREFORE, BE IT RESOLVED that:

1. The Foster City General Plan is hereby amended to add the Noise Element which can be used as a guide in planning and implementing noise attenuation.
2. The Commission approves said Noise Element and endorses it for consideration by the City Council of the City of Foster City.
3. A certified copy of this Resolution shall be prepared and bound in with all copies of the Noise Element as an indication of the endorsement and approval of this Commission.

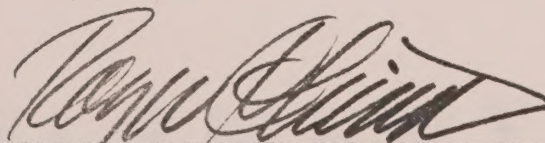
PASSED AND ADOPTED by the City of Foster City Planning Commission at a Regular Meeting thereof held on the 8th day of January, 1976, by the following vote of the members thereof:

AYES: Commissioners Dozier, Hong, Kundupoglu and Chairman Chinn.

NOES: None.

ABSENT: Commissioner King.

ABSTAIN: None.



ROGER CHINN, CHAIRMAN
City of Foster City Planning Commission

RESOLUTION NO. P-1-76

A RESOLUTION OF THE FOSTER CITY PLANNING COMMISSION ENDORSING THE FOSTER CITY GENERAL PLAN BY ADOPTING AND ENDORSING THE NOISE ELEMENT AS A PART OF SAID PLAN

CITY OF FOSTER CITY PLANNING COMMISSION

BE IT RESOLVED BY THE CITY OF FOSTER CITY PLANNING COMMISSION, as follows:

WHEREAS, said Noise Element was heard after notice duly given before this Commission on October 18, 1975, continued to November 5, 1975, continued to November 20, 1975, continued to November 21, 1975, continued to December 4, 1975, continued to December 18, 1975, and continued to January 8, 1976, at which time all persons interested were given the opportunity to be heard; and

WHEREAS, this Commission has given due consideration of said Element as presented.

NOW, THEREFORE, BE IT RESOLVED that:

1. The Foster City General Plan is hereby amended to add the Noise Element which can be used as a guide in planning and implementing noise abatement.
2. The Commission approves said Noise Element and endorses it for consideration by the City Council of the City of Foster City.
3. A certified copy of this Resolution shall be prepared and bound in with all copies of the Noise Element as an indication of the endorsement and approval of this Commission.

PASSED AND ADOPTED by the City of Foster City Planning Commission at a Regular Meeting thereof held on the 21st day of January, 1976, by the following vote of the members thereof:

AYES: Commissioners Foster, Hunt, Gumpert and Chairman Chinn.

NOTES: None

ABSENT: Commissioner Winn

ABSENT: None

ROSEMARY CHINN, CHAIRMAN
City of Foster City Planning Commission

NOISE ELEMENT

PREPARED FOR THE FOSTER CITY PLANNING COMMISSION
BY THE FOSTER CITY PLANNING DEPARTMENT

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TABLE OF CONTENTS

	<u>Page</u>
<u>TABLE OF CONTENTS</u>	i
<u>EXHIBITS AND TABLES</u>	iii
<u>FINDINGS AND RECOMMENDATIONS</u>	1
<u>GOALS AND OBJECTIVES</u>	
Goals and Objectives	3
<u>INTRODUCTION</u>	
Authority	5
Purpose	6
Approach	6
<u>BACKGROUND</u>	
Noise	7
Properties of Sound	7
<u>MEASUREMENT METHODS</u>	
Community Noise Equivalent Level (CNEL)	12
Statistical A-Weighted Noise Level (L_{10})	14
Use of L_{10} System	14
<u>MAJOR NOISE SOURCES</u>	
Transportation Related Noise Sources	16
Site Related Noise Sources	18
Noise Contour Maps	18
Specific Areas Affected by Noise	19
<u>NOISE CONTROL STANDARDS</u>	
Standards Which Apply to Noise Sources	27
Standards Which Relate Land Use to Noise Levels	29

TABLE OF CONTENTS

Page	
1	TABLE OF CONTENTS
111	EXHIBITS AND TABLES
1	FINDINGS AND RECOMMENDATIONS
	GOALS AND OBJECTIVES
3	Goals and Objectives
	INTRODUCTION
2	Authority
2	Purpose
2	Approach
	BACKGROUND
7	Noise
7	Properties of Sound
	MEASUREMENT METHOD
12	Community Noise Equivalent Level (CNEL)
14	Statistical A-Weighted Noise Level (LA)
14	Use of LA System
	MAJOR NOISE SOURCES
16	Transportation Related Noise Sources
18	Site Related Noise Sources
18	Noise Control Measures
19	Specific Areas Affected by Noise
	NOISE CONTROL STANDARDS
27	Standards Which Apply to Noise Sources
29	Standards Which Relate Land Use to Noise Levels

Page

MITIGATING NOISE PROBLEMS

Control at Source	32
Control Along Transmission Path	33
Control at Receiver	33
Implementation	34

INFORMATIONAL RESOURCES

State Highways	37
Calculated Levels (L ₁₀)	37
San Mateo County Airport Land Use Committee	38

MITIGATING NOISE PROBLEMS

32	Control at Source
33	Control Along Transmission Path
33	Control at Receiver
34	Implementation

INFORMATIONAL RESOURCES

37	State Highways
37	Calculated Levels (L ₁₀)
38	San Mateo County Airport Land Use Committee

EXHIBITS

	<u>Page</u>
A. Various Noise Measurement Methods	13
B. Existing Noise Contour, Highways 101 and 92 and Airports	21
C. Predicted Noise Contour, Highways 101 and 92	22
D. Existing Noise Contour, Local Streets	23
E. Predicted Noise Contour, Local Streets	24

TABLES

	<u>Page</u>
A. Various Noise Sources	9
B. Typical Decibel (dBA) Values Encountered in Daily Life and Industry	27
C. California Motor Vehicle Noise Standards	29
D. Interim Airport Land Use Plan - San Francisco and San Carlos Airport Plan Areas	30

EXHIBITS

Page

13	A. Various Noise Measurement Methods
21	B. Existing Noise Contour, Highways 101 and 95 and Airport
22	C. Predicted Noise Contour, Highways 101 and 95
23	D. Existing Noise Contour, Local Streets
24	E. Predicted Noise Contour, Local Streets

TABLES

Page

2	A. Various Noise Sources
27	B. Typical Decibel (dBA) Values Encountered in Daily Life and Industry
29	C. California Motor Vehicle Noise Standards
30	D. Interim Airport Land Use Plan - San Francisco and San Carlos Airport Plan Areas

FINDINGS AND RECOMMENDATIONS

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FINDINGS AND RECOMMENDATIONS

- . The most pervading noise source in Foster City is from aircraft. Such noise source is prevalent throughout all neighborhoods with highest concentrations found in Neighborhood 2 and Neighborhood 8. Most aircraft noise results from flights to or from San Francisco International Airport and San Carlos Airport.
- . Secondary, but significant, are sources of noise generated from vehicular traffic such as cars, trucks, busses and motorcycles.
- . Other noise sources, but of a temporary nature, are construction sites, power mowers, tools such as saws and barking dogs.
- . Standards for the control of the most significant noise sources, aircraft and motor vehicles are established by Federal and State regulations. In the area of motor vehicles the City can apply mitigating measures in the area of operation and facility design (speed control, surface maintenance, etc.) Noise impacts of aircraft operations can be mitigated by cooperative efforts of local governments and aircraft, airline and airport officials.
- . The control of noise along its path or at the receiver places the burden of attenuation on those who do not produce the noise. It is therefore most desirable to control noise at its source.
- . The City should use the resources of the General Plan, Noise Element and the zoning and building regulations as the major tools in implementing the Noise Element.

THEORY OF THE EARTH

The first part of the book is devoted to the study of the earth's structure and composition. It begins with a description of the earth's layers, from the crust to the core, and discusses the various materials that make up each layer. The author then goes on to discuss the processes that have shaped the earth's surface, such as erosion, sedimentation, and tectonics. This part of the book is essential for understanding the basic principles of geology and the history of the earth.

The second part of the book is devoted to the study of the earth's climate and weather. It begins with a discussion of the factors that influence the earth's climate, such as the sun, the atmosphere, and the oceans. The author then goes on to discuss the various types of weather and climate, and the processes that lead to their formation. This part of the book is essential for understanding the basic principles of meteorology and the history of the earth's climate.

The third part of the book is devoted to the study of the earth's life and evolution. It begins with a discussion of the various types of life that have existed on the earth, from simple organisms to complex animals. The author then goes on to discuss the processes that have led to the evolution of life, such as natural selection and genetic drift. This part of the book is essential for understanding the basic principles of biology and the history of life on the earth.

The fourth part of the book is devoted to the study of the earth's resources and their use. It begins with a discussion of the various types of resources that are available on the earth, such as minerals, fossil fuels, and water. The author then goes on to discuss the processes that have led to the depletion of these resources, and the various ways in which they can be conserved and used more sustainably. This part of the book is essential for understanding the basic principles of environmental science and the history of human civilization.

- . The City should establish a system of noise review as part of the review process for architectural review and planned development projects to insure that noise standards are met and that the objectives of the adopted Noise Element are implemented.

The City should establish a system of noise review as part of the review process for architectural review and planned development projects to insure that noise standards are met and that the objectives of the adopted noise element are implemented.

GOALS AND OBJECTIVES

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GOALS AND OBJECTIVES

The following represent the goals and objectives as established by the Noise Element of the General Plan.

Goals

- . To minimize occurrence of excessive noise levels.
- . To insure that noise levels at least do not increase over present values.
- . To define noise impacted locations and provide for their regulation.
- . To require that the location and design of development should incorporate treatment of surrounding noise impact.
- . To encourage a public awareness of noise and its effects upon those community qualities which create a pleasing and safe environment.

Objectives

- . That the zoning regulations be amended to include regulation to implement sound attenuation and to establish standards for land use noise emissions.
- . That the City building inspection function comply with all requirements of the California State Code respecting acoustical review of building plans.
- . That a Noise Control Ordinance be adopted which would establish limits for source noise levels for residential, commercial, industrial and public property uses.
- . That the State and local law enforcement agencies institute more active program in the reduction of excessive vehicle noise.
- . That the City vigorously pursue steps towards a joint agreement with other local governments to urge and cooperate with the SFIA, the FAA, and the airlines to help abate unnecessary noise from the airport.

GOALS AND OBJECTIVES

The following represent the goals and objectives as established by the Noise Element of the General Plan.

Goals

- To minimize occurrence of excessive noise levels.
- To insure that noise levels at least do not increase over present values.
- To define noise impacted locations and provide for their regulation.
- To require that the location and design of development should incorporate treatment of surrounding noise impact.
- To encourage a public awareness of noise and its effects upon those community qualities which create a pleasing and safe environment.

Objectives

- That the zoning regulations be amended to include regulation to implement sound attenuation and to establish standards to land use noise criteria.
- That the City be given immediate attention regarding all a pursuant to the California State Code regarding acquisition review of building plans.
- That a noise control ordinance be enacted which would establish limits for noise levels in the residential community, district, and public assembly areas.
- That the State and local law enforcement agencies establish and enforce limits on the reduction of excessive vehicle noise.
- That the City vigorously enforce noise limits, a point agreement with other local agencies to enforce and coordinate with the State, the City and the various local noise sources to reduce noise from the community.

- . That the Public Works Department review its maintenance activities for noise impacts (surface maintenance, type of streets, equipment used in work, etc.)
- . That Environmental Impact Reports prepared for public or private projects address noise impact and develop feasible noise mitigation.
- . That a public information program be instituted to create a greater awareness of noise and the various methods and techniques that can be used to reduce excessive noise levels.

That the Public Works Department, under its maintenance activities for noise sources (construction, repair of streets, equipment used in work, etc.)

That the Departmental Road Board should be provided for public or private projects which would result in developing feasible noise mitigation.

That a public information program be established to create a greater awareness of noise and the various methods and techniques that can be used to reduce excessive noise levels.

INTRODUCTION

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INTRODUCTION

Although not normally thought of in the same way as air or water, noise is a form of environmental pollution which can and does directly affect the quality of life. In the past noise has been accepted as an unpleasant but inevitable part of urban growth and development, however, today significant steps are being taken to recognize the problems presented by noise and to establish various noise control measures to reduce or prevent high levels of noise exposure.

Authority

Section 65300 of the State Government Code requires that each planning agency shall propose and each city shall adopt a General Plan for its physical development. In addition, State Government Code Section 65302(g) requires that a General Plan shall include a Noise Element as follows:

"A noise element in quantitative, numerical terms, showing contours of present and projected noise levels associated with all existing and proposed major transportation elements. These include but are not limited to the following:

- (1) Highways and freeways
- (2) Ground rapid transit systems
- (3) Ground facilities associated with all airports operating under a permit from the State Department of Aeronautics.

These noise contours may be expressed in any standard acoustical scale which includes both the magnitude to

Introduction

Although not normally thought of as the same as air or water, noise is a form of environmental pollution which can and does adversely affect the quality of life. In the past noise has been accepted as an unpleasant but inevitable part of urban growth and development. However, today's different scene has led to a recognition that noise presents a serious and in certain cases a health hazard. Noise control measures to reduce or prevent high levels of noise exposure.

Background

Section 8200 of the State Government Code requires that each planning agency shall prepare and submit to the State Department of Planning for its periodic review. In addition, State Government Code Section 82001 requires that a local plan shall include a noise element as follows:

A noise element in a local plan shall, among other things, identify the sources of noise and anticipated noise levels, identify the areas of the community which are most susceptible to noise, and identify the areas of the community which are most likely to be affected by noise.

(1) Highway and Freeway

(2) Airport and Airfield

(3) Other facilities associated with the airport
The element shall also identify the State Department of Transportation.

These noise sources shall be identified in the standard
identified noise levels which are the maximum to

noise and frequency of its occurrence. The recommended scale is sound level A, as measured with A-weighting network of a standard sound level meter, with corrections added for the time duration per event and the total number of events per 24-hour period.

Noise contours shall be shown in minimum increments of five decibels and shall be continued down to 65 db(A). For regions involving hospitals, rest homes, long term medical or mental care, or outdoor recreational areas, the contours shall be continued down to 45 db(A).

Conclusions regarding appropriate site or route selection alternatives or noise impact upon compatible land uses shall be included in the General Plan.

The state local, or private agency responsible for the construction or maintenance of such transportation facilities shall provide to the local agency producing the General Plan, a statement of the present and projected noise levels of the facility and any information that was used in the development of such levels."

Purpose

The purpose of the noise element of the Foster City General Plan is to examine and evaluate in quantitative terms the major noise sources within Foster City and to establish city-wide goals and policies in combination with significant implementation measures aimed at preserving and improving the noise level quality for the community.

Approach

The State through its planning enabling laws has empowered cities to regulate development with specific regard to noise compatibility. In order to establish an effective strategy for reducing noise impacts, however, an evaluation must be made of noise characteristics, sources, and the various control standards so that effective goals and policies for noise abatement and control can be established and workable and valid implementive programs can be instituted.

noise and frequency of occurrence. The recommended scale is sound level A, as measured with A-weighting, relative to a standard sound level meter, with corrections added for the time duration, day-evening-night (DEN) number of events per 24-hour period.

Noise contours shall be shown in minimum increments of five decibels and shall be continuous down to 25 dB(A). For routine mapping purposes, use a normal, long term, medical or mental noise, or outdoor recreational areas, the contours shall be continuous down to 25 dB(A).

Contours resulting from the noise assessment shall be included in the final plan. Contours resulting from the noise assessment shall be included in the final plan.

The state local, or private agency responsible for the construction or maintenance of such transportation facilities shall provide to the local agency producing the final plan, a statement of the project and project noise levels of the facility and any information that was used in the development of such levels.

Purpose

The purpose of the noise element of the Foster City General Plan is to examine and evaluate in quantitative terms the major noise sources within Foster City and to establish city-wide goals and policies in combination with significant transportation projects aimed at preventing and improving the noise level quality for the community.

Approach

The State through its planning agencies has set numerous goals to regulate development with specific regard to noise compatibility. In order to establish an effective strategy for reducing noise impacts, however, an evaluation must be made of noise characteristics, sources, and the various control elements so that effective goals and policies for noise assessment and control can be established and workable and valid legislative programs can be instituted.

BACKGROUND

Background

Noise

Noise can be more easily defined as unwanted sound. The degree of annoyance from sound is subjective, what might be music to one person may be irritating noise to another. There are various variables which affect the degree of annoyance - eg. a dog barking at the back of the garden is usually viewed with less annoyance than one barking at the back of the room. Noise impacts may include the following:

Psychological effects - annoyance, fear, interference with work, disturbance of sleep and rest.

Physiological effects - hearing loss (temporary or permanent), heart failure, nausea, loss of muscle control, blurring of vision.

Sociological effects - interference with speech and communication.

Economic effects - reduction of productivity, loss of productivity level.

Measurement of Noise

It is not the intent of this report to provide a technical treatise on the science of sound, but it is necessary and important that a basic understanding of sound characteristics and terminology be provided in order to arrive at a basis for formulating goals and policies and interpreting the results when in implementing effective noise control programs.

Sound waves travel through the air in the form of small pressure changes. Mathematically these are called sinusoidal pressure - the wave pressure at any point is measured as a parameter. The average deviation in

pressure above or below the static value is called sound pressure, which is related to the loudness of a sound.

To measure the relative pressure of different sounds, the decibel is used (abbreviated db). It is equal to 20 times the logarithm of the ratio of sound pressure to reference pressure $0.0002 \text{ degree/cm}^2$:

$$\text{Sound pressure level (db)} = 20 \log_{10} \frac{\text{measured pressure}}{\text{reference pressure}}$$

This is a convenient tool to indicate the ratios of loud sounds to softer ones. A sound with 10 times the pressure of another is 20 db louder and each succeeding 10-fold increase adds another 20 db to the level of sound:

10 times the pressure =	20 db louder
100 times the pressure =	40 db louder
1,000 times the pressure =	60 db louder
10,000 times the pressure =	80 db louder
100,000 times the pressure =	100 db louder

Table A illustrates this factor as it relates to various sound sources.

The decibel measure gives a rough connection between the physical intensity of sound and the subjective loudness it causes. There is an important distinction between sound pressure and loudness. Pressure is a physical factor which can be precisely measured, but loudness is sensed by the ear. Loudness of a sound is not directly proportional to its pressure. There is a built-in mechanism in the ear which automatically reduces its sensitivity as the pressure increases. For example, when the pressure of sound is doubled, the loudness increases only about 50 percent. Tripling the pressure doubles the loudness. Consequently the ear is useful over an enormous range of sound pressure levels.

It should also be stated that the ear is not equally sensitive to all sound frequencies or pitches so even though two different sounds produce the same sound pressure one sound may be sensed to be louder than the

pressure above or below the static value is called sound pressure.

which is related to the loudness of a sound.

To measure the relative pressure of different sounds, the decibel is used.

(abbreviated dB). It is equal to 20 times the logarithm of the ratio of

sound pressure to reference pressure. (1000 dynes/cm²)

Sound pressure level (SPL) = 20 log (sound pressure / reference pressure)

This is a convenient way to indicate the relative loudness of sounds.

ones. A sound with 10 times the pressure of another is 20 dB louder and

each succeeding 10-fold increase adds another 20 dB to the level of sound:

10,000 dynes/cm² = 100 dB
1,000 dynes/cm² = 80 dB
100 dynes/cm² = 60 dB
10 dynes/cm² = 40 dB
1 dyne/cm² = 20 dB

Table A illustrates this factor as it relates to various sound intensities.

The decibel measure gives a rough indication between the physical inten-

sity of sound and the subjective loudness of sound. There is an important

distinction between sound pressure and loudness. Loudness is a physical

factor which can be precisely measured, but loudness is sensed by the ear.

Loudness of a sound is not directly proportional to its pressure. There

is a built-in mechanism in the ear which automatically reduces its sensi-

tivity as the pressure increases. For example, when the pressure of sound

is doubled, the loudness increases only about 25 percent. Tripling the

pressure doubles the loudness. Consequently the ear is useful over an

enormous range of sound pressure levels.

It should also be noted that the ear is not equally sensitive to all

sound frequencies. Frequencies between 2000 and 5000 cycles per second produce

the same sound pressure but cannot say be heard as loud as those in the

TABLE A
VARIOUS NOISE SOURCES

APPARENT LOUDNESS	SELECTED SOURCES	DECIBELS	RATIO TO 0 db	COMMUNITY REACTION TO OUTDOOR NOISE
Deafening	Jet Aircraft	140	10,000,000	Vigorous Action
	Threshold of Feeling	130	3,162,000	
Painfully Loud	Jet Takeoff Thunder	120	1,000,000	
	Chipping Hammer	110	316,200	
	Noisy Industrial Area School Area	100	100,000	
Very Loud	Aircraft Low Flyover Loud Street Noise Park Area	90	31,620	Threats
	Noisy Office Vacuum Cleaner	80	10,000	
Loud	Freeway Traffic	70	3,162	Widespread Complaints
	Average Street Noise Average Office	60	1,000	
Moderate	Light Traffic Average Residence 2 Person Conversation	50	316	Occasional Complaints
	Private Office School Classroom	40	100	
Faint	In Home, Quiet Suburb Bedroom	30	32	No Noticeable Action
	Rustling Leaves	20	10	
Very Faint	Normal Breathing	10	3	
	Threshold of Audibility	0	1	

other if its energy is concentrated in a frequency or pitch where the ear is more sensitive.

The decibel values dB(A) or dbA are for those sound levels measured using the A-weighting network of a standardized sound level meter. The A-weighting network closely approximates the frequency response of the human ear, and the associated levels can be time averaged to yield average sound pressure levels which have been widely correlated with degrees of community impact and annoyance.

The noise contour is a line on a map where anywhere along that line the same sound pressure level prevails.

The noise exposure level is the combination of a noise level in A-weighted decibels and a time duration for that noise level. For example, an "L80" designation indicates a sound pressure level that is exceeded 80% of the time. This designation is sometimes used to determine the ambient or background noise exposure level.

Although applicable to any type of noise source Community Noise Equivalent Level (CNEL) values are generally used to show noise contours around airports. CNEL is specifically a time weighted measure to more heavily weight nighttime noise.

A noise problem usually consists of three distinct components: a source, transmission path, and a receiver. To abate the noise problem, one or more of the components have to be eliminated, changed or controlled. The implementation section of this element will discuss the various methods and techniques that can be used to handle noise problems.

other it is energy is concentrated in a frequency or pitch where the ear is more sensitive.

The desired value (50%) or the ear's response is measured using the A-weighting network of a standardized sound level meter. The A-weighting network closely approximates the frequency response of the human ear, and the associated levels can be time averaged to yield average sound pressure levels which have been widely correlated with the great of community impact and annoyance.

The noise contour is a line on a map where somewhere along that line the same sound pressure level prevails.

The noise exposure level is the combination of a noise level in A-weighted decibels and a time duration for that noise level. For example, an "L50" designation indicates a sound pressure level that is exceeded 50% of the time. This designation is sometimes used to determine the extent of background noise exposure level.

Although not identical to any type of noise contour, noise exposure level (NEL) values are generally used to show noise contours around airports. NEL is conceptually a time weighted measure to more heavily weight nighttime noise.

A noise problem usually consists of three distinct components: a source, transmission path, and a receptor. To solve the noise problem, one or more of the components have to be eliminated, changed or controlled. The information section of this document will discuss the various methods and techniques that can be used to solve noise problems.

MEASUREMENT METHODS

MEASUREMENT METHODS

Noise sources increasing in number and strength as our society advances, add to the tension of urban life. The proliferating din caused by home air conditioners, power mowers, power saws, compactor-type trash trucks, street sweepers, motorcycles, sports cars and commercial aircraft takes its toll on our nerves and our sense of well-being. Consequently, a large percentage of noise research has been devoted to identifying and quantifying the disturbing and annoying quality of noise. Disturbances created by noise are a behavioral effect and consequently highly subjective. Individuals react to community noise with complaints, refusal to purchase property in noise impacted areas, moving out of noisy areas and failing to keep up property.

A great deal of effort has been spent by researchers to quantify the physical characteristics of sounds with the psychological response to them. The physical aspects deal with radiation and transmission of sound in the air, while the psychological treats subject response of humans to sound. The principal variable linking these factors is intensity of sound.

The most common unit used in the measurement of sound is the decibel (dB). Precision sound level measurements are made with an instrument called a sound level meter. The sound level measurements (in decibels, dB) are adjusted through frequency filters on the meter which remove specific parts of the total sound spectrum. The most commonly used fre-

quency filters are called A, B and C networks. The "A-weighted" network is most used since it measures frequencies approximating the response of the human ear at moderate sound levels. The A-weighted network is abbreviated as dB(A). It should be noted that dB(A) values do not give the full picture since additional data, such as exposure time and spectral analysis, are needed to quantify the subjective magnitude of sound.

Many different methods are used to measure noise. Exhibit A identifies various measuring methods and describes briefly how the method is derived. Two methods not shown in this table but which are in common usage are described below. They are the Community Noise Equivalent Level (CNEL) and the Statistical A-Weighted Noise Level (L_{10}).

Community Noise Equivalent Level (CNEL)

This measurement method has been derived for use in measuring the reaction of the community to airport-related noises. This method also has general applicability to measurement of general noise levels in the community. This system provides an average noise level during a 24-hour day, adjusted to an equivalent level which is "period-weighted" so as to assign greater importance to noise during evening and nighttime periods relative to daytime periods. This weighting is justified on the basis that people's tolerance to noise is lower during evening and nighttime than during the day. This system is adapted for assessment of aircraft noise and is used by the California Department of Aeronautics. A disadvantage of CNEL is that the measurements and calculations are difficult and time consuming. This system uses the A-weighted decibel.

quency filters are called A, F and L networks. The "A-weighted" network is most used since it measures frequencies approximating the response of the human ear at moderate sound levels. The "F-weighted" network is characterized as follows. It should be noted that dB(A) values do not give the full picture since additional data, such as the nature time and spectral analysis, are needed to quantify the subjective magnitude of sound.

Many different methods are used to measure noise. Exhibit A identifies various measuring methods and compares briefly how the method is derived. Two methods not shown in this table but which are in common usage are described below. They are the Community Noise Equivalent Level (CNEL) and the Statistical A-Weighted Noise Level (L₅₀).

Community Noise Equivalent Level (CNEL)

This measurement method has been devised for use in measuring the variation of the community in noise-related noise. This method also has general applicability in measurement of general noise levels in the community. This system provides an average noise level during a 24-hour day, adjusted to a continuous level which is "noise-weighted" so as to assign greater importance to noise during evening and nighttime periods relative to daytime periods. This weighting is justified on the basis that people's tolerance for noise is lower during evening and nighttime than during the day. This system is regarded as assessment of overall noise and is used by the California Department of Transportation. A disadvantage of CNEL is that the measurement and calculation are difficult and time consuming. This system uses the A-weighted method.

EXHIBIT A

VARIOUS NOISE MEASUREMENT METHODS

The most basic sound measurement

Sound Pressure Level (SPL)
measured in dB

The A-weighting network reflects the frequency response of the human ear

A-Scale Sound Level (SPL)
measured in dBA

A-weighting Network

A computation of the annoyance level of motor vehicle noise

Traffic Noise Index (TNI)

Correction for Statistical Distribution

A procedure for estimating annoyance caused by any noise source

Noise Pollution Level (NPL)
expressed by LNP (dB)

A procedure for predicting community reaction to noise environments

Composite Noise Rating (CNR)

Correction for
• Ambient Noise Level
• Number of occurrences
• Time of day
• Season of year

A computation of loudness. A linear unit used to rate consumer or industrial products

Loudness Rating Expressed in Sones

Computation of Loudness

A computation of the noisiness level of a single spectrum of an aircraft flyover

Perceived Noise Level (PNL)
expressed in PN (dB)

Computation of Noisiness

A computation of aircraft annoyance level for a complete flyover

Effective Perceived Noise Level (EPNL)
expressed in EPN (dB)

Corrections for:
• pure tone
• duration

A procedure for predicting community reaction to flyovers by commercial aircraft

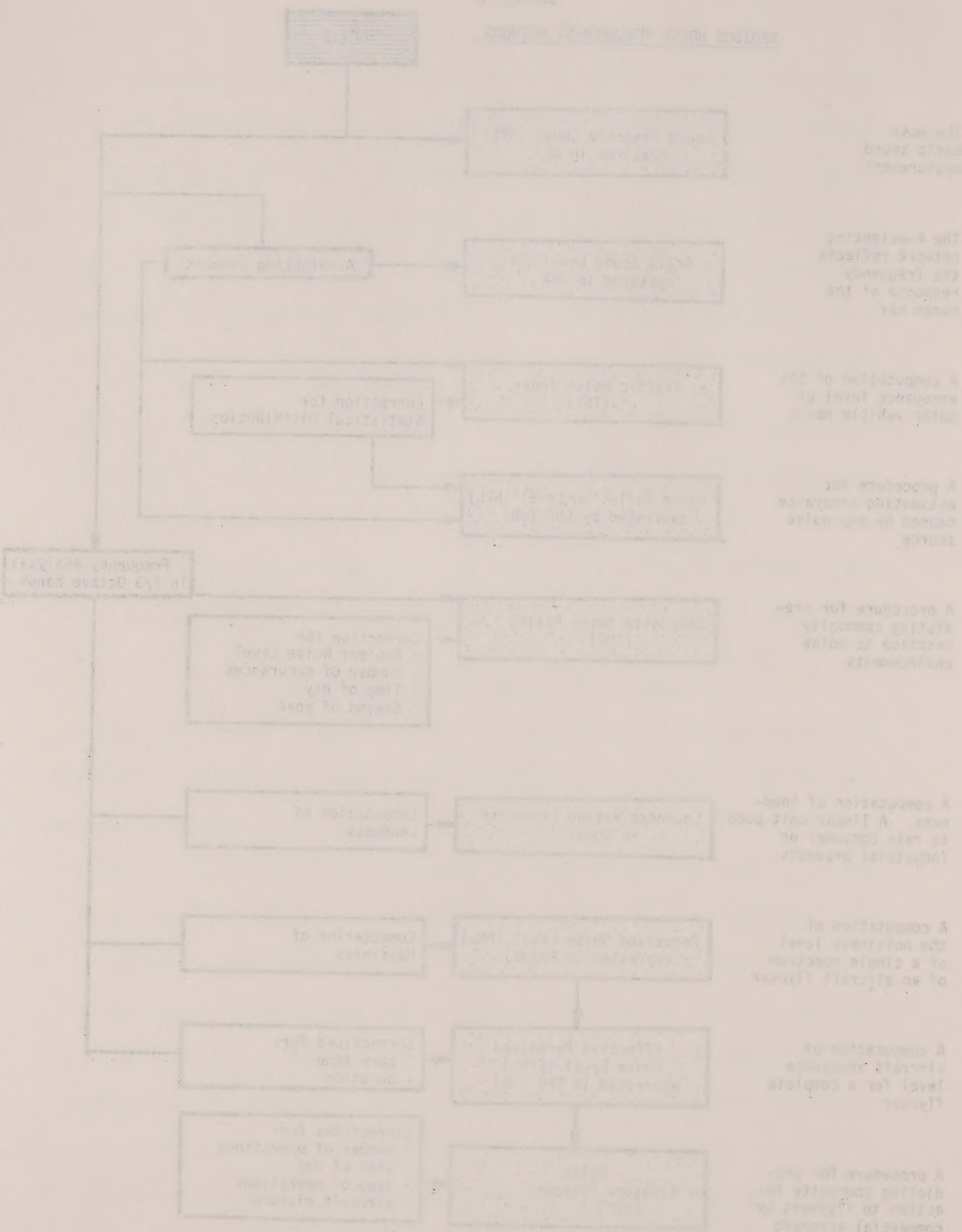
Noise Exposure Forecast (NEF)

Corrections for:
• number of operations
• time of day
• type of operations
• aircraft mixture

Frequency Analysis in 1/3 Octave bands

Source: Environmental Noise Abatement. B & K Instruments, Inc.

VARIOUS NOISE MEASUREMENT METHODS



Statistical A-Weighted Noise Level (L₁₀)

L₁₀ represents an A-weighted level which is exceeded 10 percent of the time over the duration of the sample noise measurement and represents a measure of the higher level, shorter duration sounds. This measurement method has been utilized for assessment of noise impact of traffic noise, where it has been applied to the peak traffic flow periods. The Federal Highway Administration standards for Federally assisted road construction are expressed in maximum L₁₀ levels during the noisiest hour of the day. Because it represents a measure of the higher order sound level occurring during the measurement period, the system has the disadvantage of not considering the impact of noise during nighttime hours when people have a lower tolerance of noise. The L₁₀ measurement method, because of its less complicated procedures, is more adaptable to community resources -- equipment and personnel.

Use of L₁₀ System

In considering the various methods used in measuring noise levels it was determined that the L₁₀ system would be the most appropriate method to use since the method has several advantages over other systems.

1. This system is easy to use and does not require any additional sound equipment or resources than presently available to the City.
2. This system is used by CalTrans for determining noise levels along state highways. Noise levels for US 101 and State 92 have been provided to the city and are represented in L₁₀

Statistical Adjustment (Lij)

Lij represents an A-weighted level which is expressed in percent of the time over the duration of the traffic noise measurement and represents a measure of the "signal level" relative to the background noise. This measure was used to adjust the equivalent of noise impact of traffic noise, where it was found that in the past traffic flow periods. The Federal Highway Administration standards for relatively assisted road construction are expressed in terms of the Lij levels during the noisiest hour of the day. Because it represents a measure of the higher order sound level decibels during the measurement period, the system has the disadvantage of not considering the impact of noise during nighttime hours when people have a lower tolerance of noise. The Lij measure method, because of its less complicated procedure, is more adaptable to community resources -- equipment and personnel.

Use of the System

In considering the various methods used in measuring noise levels it was determined that the Lij system would be the most accurate method to use since the method for sound level measurement over other systems.

1. This system is easy to use and does not require any additional sound equipment or resources that presently available to the city.

2. This system is used by California for determining noise levels along state highways. Noise levels for the 101 and 205 highways have been measured in the city and are represented in Lij

measurements. As this system is not readily convertible to other measurement systems it would be more consistent and comparable to use this same system for measuring noise sources on our own local street system.

3. The CNEL system which is used to measure aircraft noise levels related to San Francisco International Airport and San Carlos Airport can be used in addition to the L_{10} system.

4. The L_{10} system, although not as accurate or precise as other more complicated systems, is adequate for general planning purposes where general location and degree of noisiness is satisfactory.

environment. As this system is not directly comparable
to other measurement systems it would be more consistent
and comparable to use this same system for measuring noise
exposure on our own local system.

4. The GWT system which is used to measure aircraft noise
levels related to San Francisco International Airport and
San Carlos Airport can be used in addition to the LTP system.
The LTP system, although not as accurate or precise as
other more sophisticated systems, is adequate for general plan-
ning purposes where detailed location and degree of noise
is satisfactory.

MAJOR NOISE SOURCES

1919-1920

MAJOR NOISE SOURCES

Noise may come from a variety of sources. It may originate from linear sources such as highways or airport landing approaches. This source is generally defined as a transportation related source. "Spot" noises may originate from a single source where a particular kind of activity exists. This noise is classified as a site related source.

Before any noise control measures can be instituted, all noise sources must be identified.

Transportation Related Noise Sources

This class of sources affects the greatest number of people in Foster City. Included within this source group are: motor vehicles (automobiles, trucks, and motorcycles), aircraft and transportation paths such as highways, major arterials and aircraft paths.

Noise contours for aircraft from San Francisco International Airport and San Carlos Airport have been prepared by the San Mateo County Airport Land Use Commission (ALUC). These contours, which are given in Community Noise Equivalent Level (CNEL) values, are shown on Exhibit B.

The greatest noise source from motor vehicles is created by trucks and tractor trailers. The average truck traveling at 45 mph on a level road produces about 86 dBA at a distance of 50 feet. Levels above 94 dBA, however, are not uncommon. Acceleration on a level road

NOISE SOURCE IDENTIFICATION

Noise may come from a variety of sources. It may originate from transport sources such as airplanes or ships, or from stationary sources. This source is generally defined as a noise source which is not a transport source. Noise may originate from a single source or from a group of sources. This noise is classified as a noise source. Before any noise control measures can be installed, all noise sources must be identified.

Transportation Noise Sources

This class of sources affects the greatest number of people in Foster City, and includes within this source group all noise sources which are located, directly or indirectly, adjacent to or near transportation paths such as highways, major waterways and airports.

Noise contours for aircraft from San Francisco International Airport and San Carlos Airport have been prepared by the San Mateo County Airport Land Use Commission (ALUC). These contours, which are given in Community Noise Equivalent Level (CNEL) values, are shown on

Exhibit B.

The greatest noise source from motor vehicles is created by trucks and tractor trailers. The average truck traveling at 45 mph on a level road produces about 85 dBA at a distance of 50 feet. Levels above 95 dBA, however, are not uncommon. Identification of a noise source

produces about 6 dBA more than steady running conditions. A three to five percent upgrade in the highway produces about 3 to 4 dBA more than on a level road.

Motorcycles, sports cars and improperly muffled automobiles produce levels similar to trucks. As with trucks, motorcycles and sports cars generate significantly higher noise levels during acceleration.

To provide existing noise level data and predict future noise levels along California's major highway system, the California Department of Transportation (Cal Trans) has estimated noise contours along the state highway system, including Highway 101 (Bayshore Freeway) and Highway 92 (J. Arthur Younger Freeway) within Foster City. These contours which are given in L_{10} values are shown on Exhibits B, C.

The City has estimated existing and predicted noise contours along the following streets, or sections of streets:

1. East Hillsdale Blvd. - City limit line to Gull Ave.
2. Foster City Blvd. - East Hillsdale Blvd. to Beach Park Blvd.
3. Edgewater Blvd. - East Hillsdale to south City limit line.
4. Beach Park Blvd. - Edgewater Blvd. to Foster City Blvd.

These contours were determined using the procedures based on the Federally approved methods found in the National Cooperative Highway Research Program, Report No. 117. These contours are shown in L_{10} designation on Exhibits D, E.

produces about 5 dBA more than steady running conditions. A three to five percent upgrade in the highway produces about 3 to 4 dBA more than on a level road.

Motorcycles, sports cars and low-powered vehicles produce levels similar to trucks. As with trucks, motorcycles and sports cars generate significantly higher noise levels during acceleration.

To provide existing noise level data and predict future noise levels along California's major highway system, the California Department of Transportation (Caltrans) has estimated noise contours along the state highway system, including Highway 70 (Bayshore Freeway) and Highway 92 (Arthur Younger Freeway) within Foster City. These contours which are given in L₁₀ values are shown on Exhibits G, E.

The City has estimated existing and predicted noise contours along the following streets, or sections of streets:

1. East Willows Rd. - City limit line to 24th Ave.
2. Foster City Blvd. - East Willows Rd. to Beach Park Blvd.
3. Edgewater Blvd. - East Willows Rd. to Foster City limit line.
4. Beach Park Blvd. - Edgewater Blvd. to Foster City Blvd.

These contours were determined using the procedures listed on the following approved methods found in the National Cooperative Highway Research Program, Report No. 117. These contours are shown in L₁₀ design on Exhibit G, F.

Site Related Noise Sources

Construction related noise is a site related source. In this group is included such items as: pile drivers, air compressors, diesel engines, electric motors, pumps, tractors, earthmoving equipment, shovels, saws, etc. These sources are annoying because of the high sound pressure levels and pulsating or intermittent nature of the noise they typically generate. These sources, however, are not permanent and are terminated after construction is completed.

Other site related noise sources include: heating and air conditioning equipment, industrial equipment, power equipment, amusement devices, public address systems, etc. Social related noises such as hi-fi, radio, children at play, animal noises, loud voices, etc., are the most difficult noises to control for they can occur anywhere and at any time. Site related noise sources associated with areas include shopping centers, manufacturing plants, warehouses, playgrounds, parks and schools.

Noise Contour Maps

The following Exhibits represent a graphic result of noise measurements and calculations made within Foster City and provide generalized contours both existing and for future conditions. Existing contours are current as of January, 1975. The L_{10} predicted contours are plotted for state highways for 1995. The L_{10} predicted contours for local streets are plotted for anticipated conditions in 1985. For San Francisco International Airport and San Carlos Airport the noise levels are plotted in Community Noise Equivalent Levels (CNEL).

In using the L_{10} system it should be noted that there are certain limi-

Site Related Noise Sources

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public address systems, etc. Local related noise such as hi-fi, radio, children at play, animal noises, loud voices, etc., are the most difficult noises to control for they can occur anywhere and at any time. Site related noise sources associated with areas include shopping centers, manufacturing plants, warehouses, playgrounds, parks and schools.

Noise Contour Maps

The following exhibits represent a graphic result of noise measurements and calculations made within Foster City and provide generalized noise contours existing and for future conditions. Existing contours are current as of January, 1975. The 10 predicted contours are plotted for state highways for 1985. The 10 predicted contours for local streets are plotted for anticipated conditions in 1985. For San Francisco International Airport and San Carlos Airport the noise levels are plotted as Community Noise Equivalent Levels (CNEL).

In using the map system it should be noted that there are certain limitations

tations which should be understood. L_{10} means that these values are exceeded only 10 percent of the time during the period which the measurements were made. Therefore, the values are normally higher than when compared with average conditions. In other words, the noise levels as shown would represent those which would probably only occur during peak hour traffic flow.

The maps as presented here provide an identification and delineation of existing noise source areas and can also be used in conjunction with adopted noise standards to identify potential noise problem areas prior to development and to provide an awareness to the developer or property owner of the possible need to provide appropriate mitigation measures necessary to permit development.

Specific Areas Affected By Noise

The most pervading noise source within Foster City is from aircraft using San Francisco International Airport and San Carlos Airport. Aircraft noise is found in varying degrees within every neighborhood. The most adversely affected area is Neighborhood 2 which is located almost directly under the approach to runway 28L to San Francisco International Airport. The frequency of this approach pattern is such that this is considered as a major noise problem for most people in this area.

Flights from San Carlos Airport have less effect upon the community as a whole but do have a greater impact upon the residents of Neighborhood 8 which are located at the northern end of the runway approach to that facility. The City has extremely limited ability in the control of noise generated by these sources. The regulation of these noise sources

tations which should be understood. ¹⁰ means that these values are exceeded only 10 percent of the time during the period which the measurements were made. Therefore, the values are normally higher than when compared with average conditions. In other words, the noise levels as shown would represent those which would probably only occur during peak hour traffic flow.

The maps as presented have provided an identification and delineation of existing noise source areas and can also be used in conjunction with adopted noise standards to identify potential noise problem areas prior to development and to provide an awareness to the developer or property owner of the possible need to provide appropriate mitigation measures necessary to permit development.

Specific Areas Affected by Noise

The most pervasive noise source within Foster City is from aircraft using San Francisco International Airport and San Carlos Airport. Aircraft noise is found in varying degrees within every neighborhood. The most adversely affected area is Neighborhood 2 which is located almost directly under the approach to runway 28L to San Francisco International Airport. The frequency of this approach pattern is such that this is considered as a major noise problem for most people in this area. Flights from San Carlos Airport have less effect upon the community as a whole but do have a greater impact upon the residents of Neighborhood 8 which are located at the northern end of the runway approach to that facility. The City has explicitly limited ability in the control of noise generated by these sources. The regulation of these noise sources

is administered by Federal agencies and the City is restricted only to controlling the noise by requiring insulation of buildings and regulating land use patterns.

Traffic noise is most prevalent along East Hillsdale Boulevard, Foster City Boulevard, Edgewater Boulevard and Beach Park Boulevard. Areas most adversely affected are the residential areas immediately adjacent to these facilities. Because of its distant relationship State Route 92 has little impact upon residential areas within the community. U. S. 101 does create a minor effect upon the western tip of Neighborhood 8 due to the unobstructed area between U. S. 101 and the neighborhood (Marina Lagoon). The City has operating restrictions on vehicles (speed control, truck exclusion, bus route design, etc.) as well as operating facility design (signalization, surface maintenance, etc.) and police power to enforce State Codes.

Commercial areas within the community are another source of noise, particularly since commercial uses are clustered and are adjacent to residential areas. Noise is generated from equipment, traffic movement, starting of vehicles, people talking, dogs barking, etc. Areas of specific concern include Marlin Cove, Beach Park and Port-O-Call. Future areas would be Charter Square, Edgewater at Beach Park, Edgewater at south City limits, area north of East Hillsdale Boulevard and east of Foster City Boulevard and Town Center. The City can control the noise generated from these sources by requiring such measures as equipment enclosures, walls, berms, planting, noise insulation, etc. Wherever possible, the City should regulate the noise at its source rather than at the receiver.

is administered by Federal agencies and the City is restricted only to controlling the noise by regulating installation of buildings and regulating land use patterns.

Traffic noise is most prevalent along East Hillside Boulevard, Foster City Boulevard, Edgewater Boulevard and Beach Park Boulevard. Areas most adversely affected are the residential areas immediately adjacent to these facilities. Because of its distant relationship to Route 92, noise impact upon residential areas within the community, U. S. 101 does create a minor effect upon the western tip of neighborhood B due to its unobstructed area between U. S. 101 and the neighborhood (Marina Lagoon). The City has operating restrictions on vehicles (speed control, truck exclusion, bus route design, etc.) as well as operating facility design (signalization, surface maintenance, etc.) and police power to enforce State Codes.

Commercial areas within the community are another source of noise, particularly since commercial uses are clustered and are adjacent to residential areas. Noise is generated from equipment, traffic movement, starting of vehicles, people talking, dogs barking, etc. Areas of specific concern include Marina Cove, Beach Park and Fort-D-Calif. Future areas would be Charter Square, Edgewater at Beach Park, Edgewater at South City Center, area north of East Hillside Boulevard and east of Foster City Boulevard and Town Center. The City can control the noise generated from these sources by regulating such measures as equipment enclosures, mufflers, painting, noise insulation, etc. Whenever possible, the City should regulate the noise at its source rather than at the receiver.

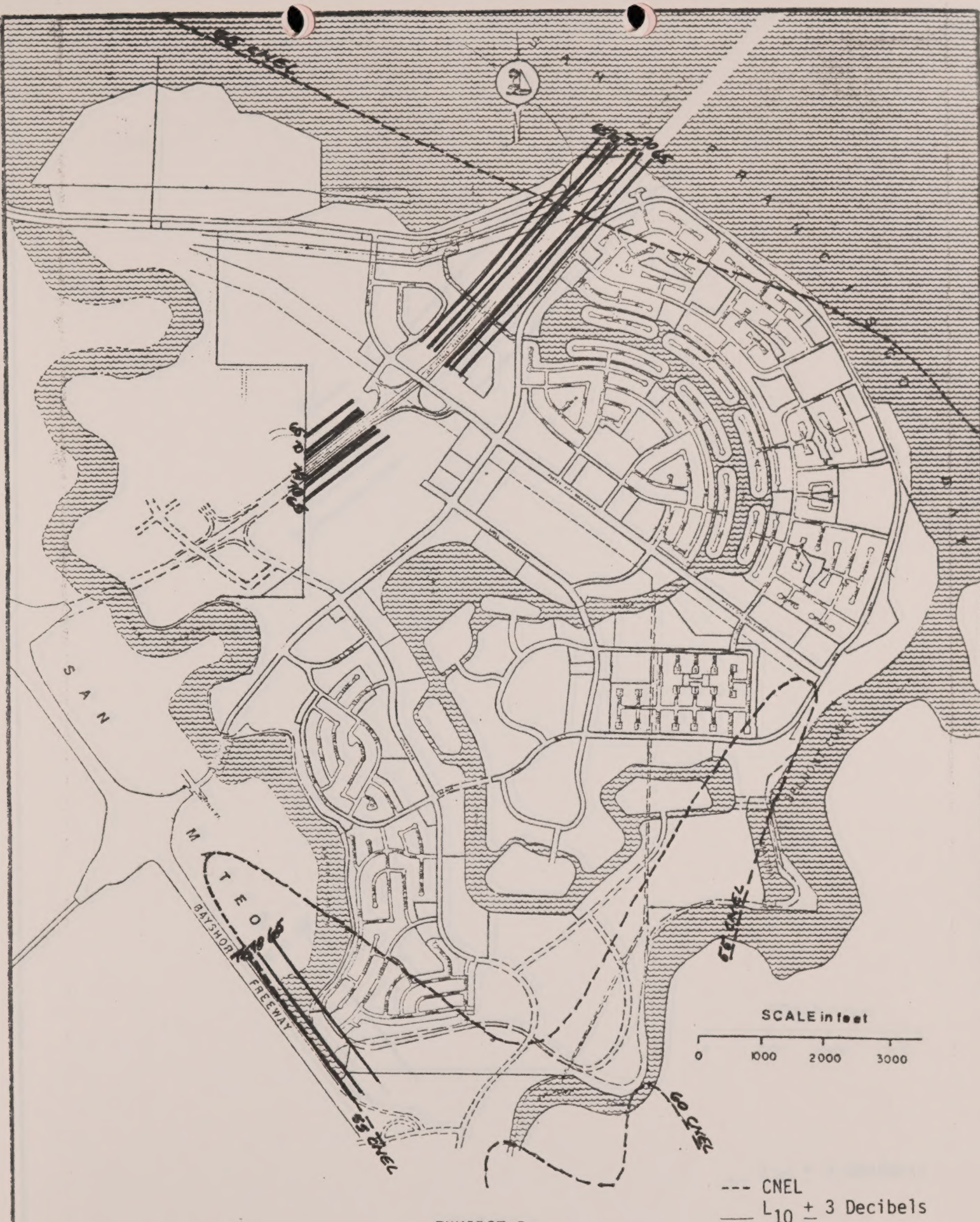


EXHIBIT B

EXISTING NOISE CONTOUR
HIGHWAYS 101 & 92 AND AIRPORTS

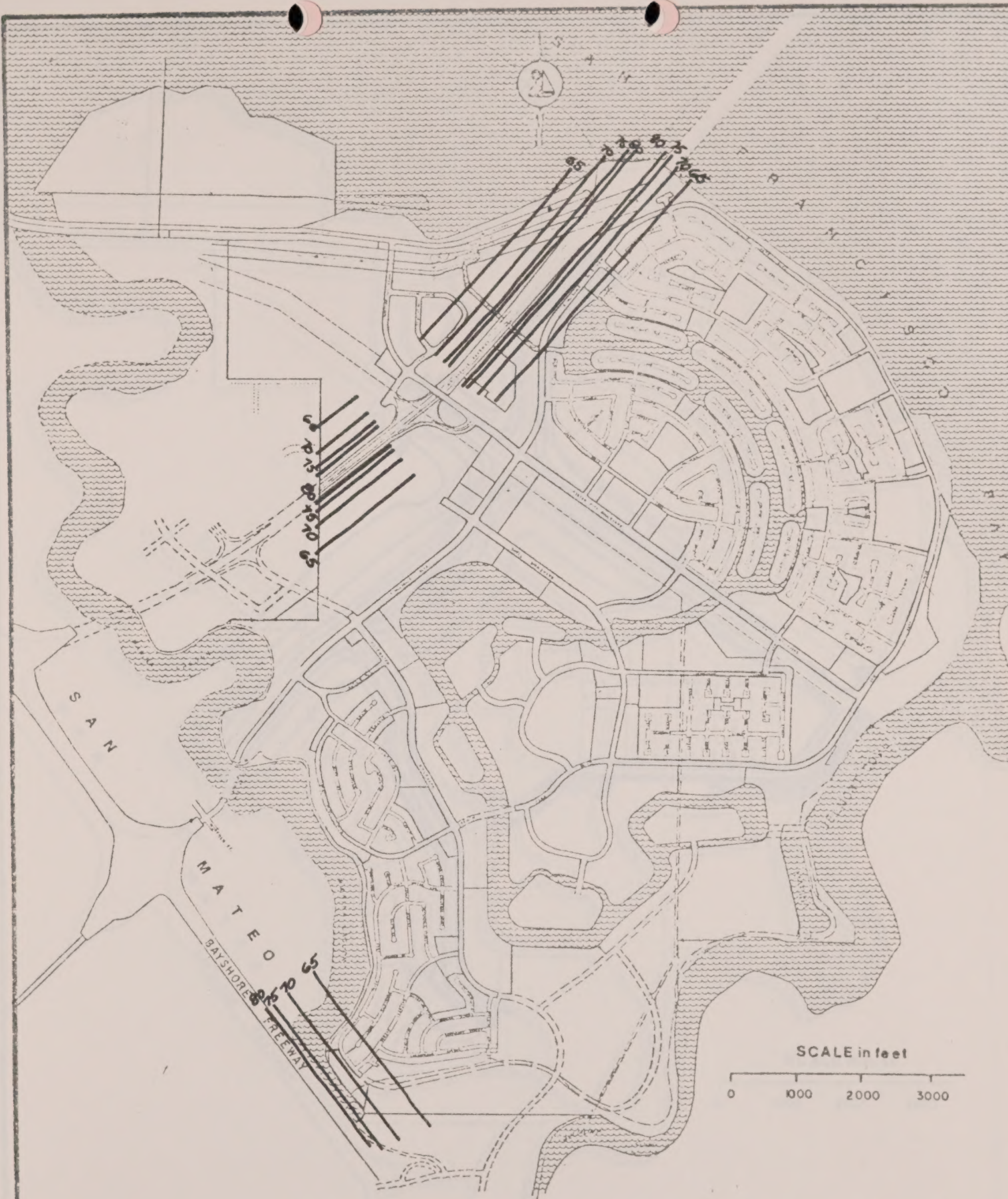


SCALE IN FEET
0 500 1000 1500

--- ROAD
--- NOISE CONTOUR

EXISTING NOISE CONTOUR
HIGHWAYS 701 & 92 AND AIRPORTS

EXHIBIT 2



— $L_{10} + 3$ Decibels

EXHIBIT C

PREDICTED NOISE CONTOUR
HIGHWAYS 101 & 92

EXHIBIT C
PREDICTED NOISE CONTOUR
HIGHWAYS 101 & 52

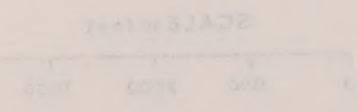
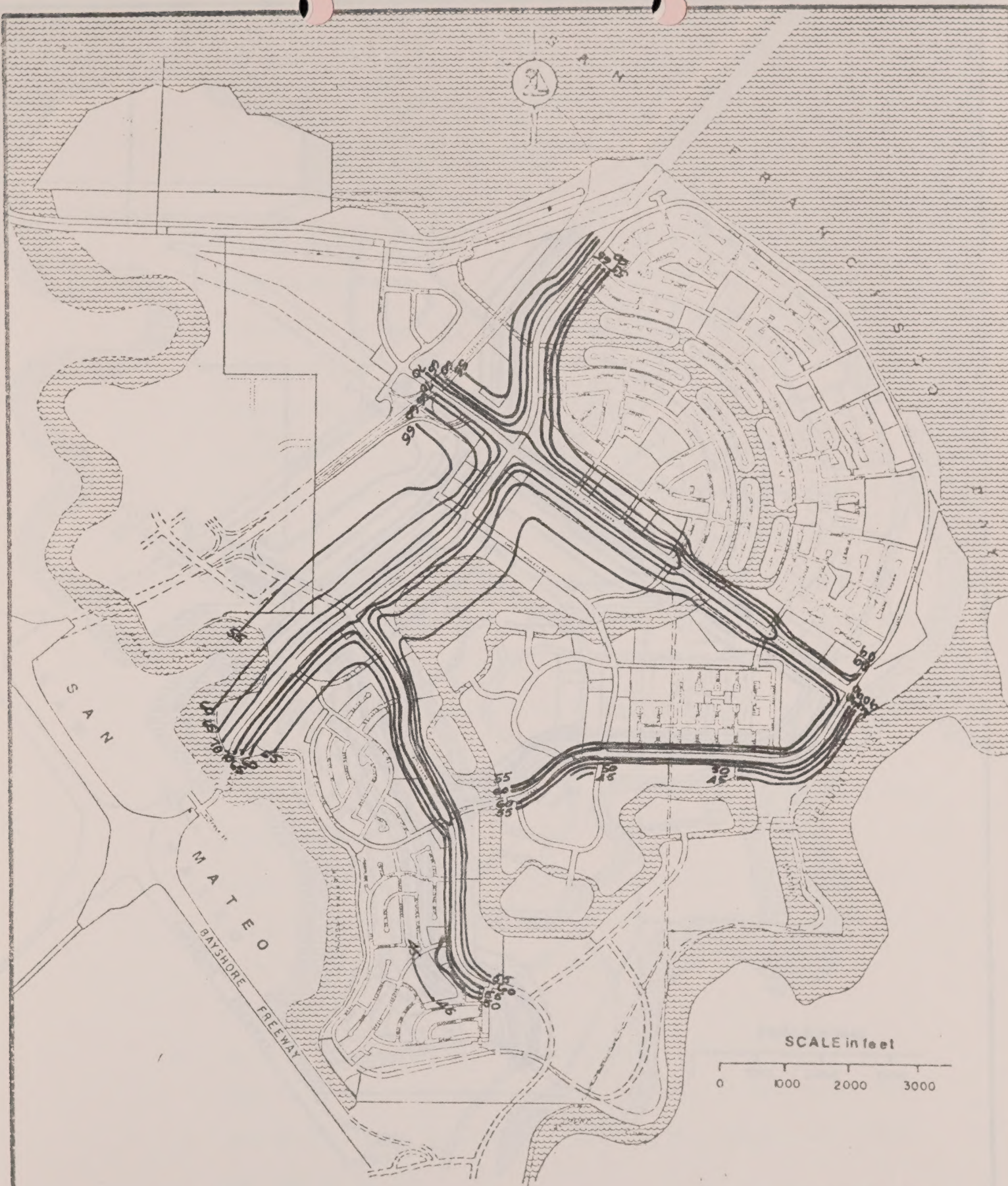


Fig. 3 Decibels





SCALE in feet

0 1000 2000 3000

— $L_{10} \pm 3$ Decibels

EXHIBIT D

EXISTING NOISE CONTOUR
LOCAL STREETS

SCALE 1:10,000
1" = 100'

10 - 3 Sheets

EXISTING NOISE CONTOUR
LOCAL STREETS

EXHIBIT D



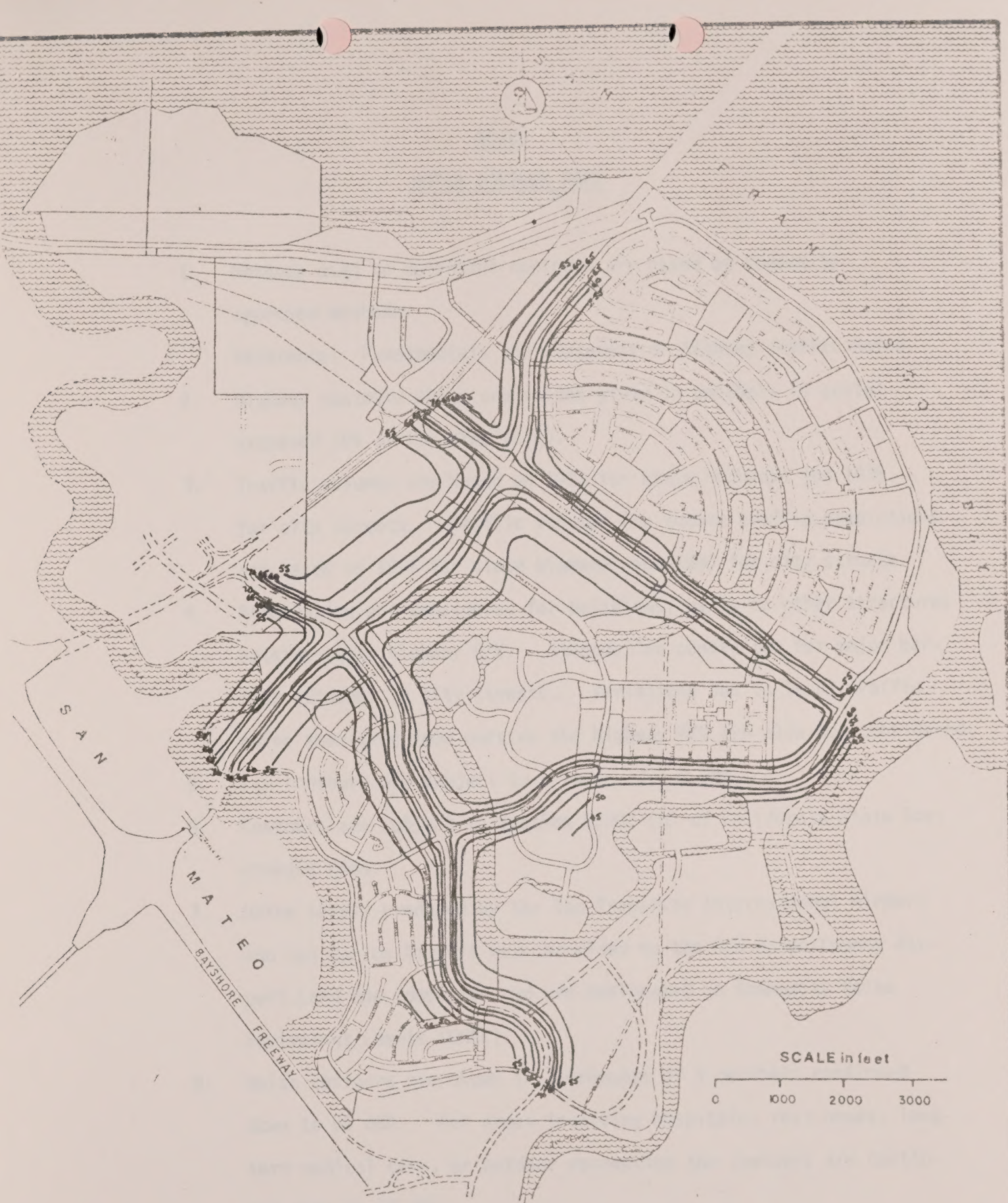
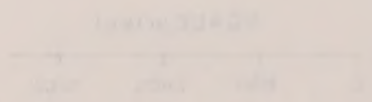


EXHIBIT E

PREDICTED NOISE CONTOUR
LOCAL STREETS



10 x 3 feet

EXHIBIT 2
PREDICTED NOISE CONTOUR
LOCAL STREETS

NOTES

NOISE CONTOUR MAPS

1. Methods used to determine contours are based on Federally approved methods.
Reference: Fundamentals and Abatement of Highway Traffic Noise.
2. Highway contours shown are values given in decibels (A scale) exceeded 10% of the time (L_{10}).
3. Traffic volumes are based on 1973 for state highways and 1975 for city streets. Traffic volumes for future traffic predictions are based on 1995 for state highways and 1985 for city streets.
4. Attenuation not considered for buildings, walls or other structures outside state highway R/W. Attenuation considered for major barrier adjacent to city streets. Variations due to local traffic noise emanating from outside the highway R/W are also not considered.
5. L_{10} contours are subject to a range of ± 3 dBA.
6. Contours are subject to Section 65302 (g) of California State Government Code.
7. Noise levels produced by the San Francisco International Airport and San Carlos Airport were provided by the San Mateo County Airport Land Use Committee and are designated in Community Noise Equivalent Levels (CNEL).
8. Noise contours are shown in increments of 5 decibels continued down to 55 dBA. For areas involving hospitals, rest homes, long-term medical care, or outdoor recreation the contours are continued down to 45 dBA.

NOTES TO THE READER

1. Methods used to determine contours are based on Federal approved methods.
2. Highway contours shown are values given in decibels (A scale) extended 10 ft. to the 100 ft.
3. Traffic values are based on 1973 for state highways and 1972 for city streets. Traffic values for future traffic predictions are based on 1985 for state highways and 1980 for city streets.
4. Attention not considered for buildings, walls or other structures outside state highway R/W. Attention considered for major bar-rier adjacent to city streets. Variations due to local traffic noise emanating from outside the highway R/W are also not considered.
5. Top contours are subject to a range of ± 1 dBA.
6. Contours are subject to Section 0410 (f) of California State Rev-erential Code.
7. Noise levels produced by the San Francisco International Airport and San Carlos Airport were provided by the San Mateo County Air-port Land Use Commission and are designated as Community Noise Equivalent Levels (CNEL).
8. Noise contours are shown in increments of 5 decibels continued down to 55 dBA. For areas involving highways, road noise, land-use (industrial) areas, or outdoor recreation the contours are contin-ued down to 50 dBA.

NOISE CONTROL STANDARDS

NOISE CONTROL STANDARDS

There are two basic forms of noise control standards which apply to noise within the urban environment. (1) standards which apply to noise sources, and (2) standards which relate land use to noise levels. These two forms of noise control are compatible and may be used concurrently. There are, however, certain basic disadvantages contained in present standards as they apply to communities and should be understood at the beginning of any discussion regarding standards. In the case of noise sources generally the principal noise generators in any community are transportation related -- motor vehicles, airplanes, trains, etc. The standards limiting noise emissions from such sources, however, are established by State and Federal agencies. Such laws preempt any City regulations. With regards to standards which relate land use to noise levels, the principal disadvantage is that they place the burden of noise attenuation on those who do not produce the noise.

Noise is generated from a great many sources both from within and outside the community. It is normally complex in its generation and subjective in its receiving. To obtain a proper perspective in identifying noise levels of various kinds of sound, the following table identifies typical noise levels that might be found in the community.

Noise Control Standards

There are two basic forms of noise control standards which apply to noise within the urban environment: (1) standards which apply to noise sources, and (2) standards which relate to noise levels. These two forms of noise control are complementary and may be used concurrently. They are, however, certain basic disadvantages contained in present standards as they apply to communities and should be understood at the beginning of any discussion regarding standards. In the case of noise sources, generally the principal noise generators in any community are transportation related -- motor vehicles, airplanes, trains, etc. The standards limiting noise emissions from such sources, however, are established by State and Federal agencies. Such laws preempt any City regulations. With regard to standards which relate to noise levels, the principal disadvantage is that they place the burden of noise abatement on those who do not produce the noise.

Noise is generated from a great many sources both from within and outside the community. It is an extremely complex in its generation and subjective in its reception. To obtain a proper perspective in identifying noise levels of various kinds of sound, the following table identifies typical noise levels that might be found in the community.

TABLE B

TYPICAL DECIBEL (dBA) VALUES
ENCOUNTERED IN DAILY LIFE AND INDUSTRY

	<u>dBA</u>
Rustling Leaves	20
Room in a Quiet Dwelling at Midnight	32
Soft Whisper at Five Feet	34
Men's Clothing Dept. of Large Store	53
Window Air Conditioner	55
Conversational Speech	60
Household Dept. of Large Store	62
Busy Restaurant or Canteen	65
Typing Pool (9 typewriters in use)	65
Vacuum Cleaner in Private Residence (at 10 ft.)	69
Electric Drill (at 10 ft.)	75
Outside Car Wash	82
(Beginning of Hearing Damage, if Prolonged)	85
Printing Press Plant (Medium Size Automatic)	86
Train Engine (150 ft. away)	90
Jackhammer (at 50 ft.)	90
Heavy Diesel Propelled Vehicle (about 25 ft. away)	92
Air Grinder	95
Chain Saw	97
Turbine Condenser	98
150 cubic foot Air Compressor	100
Banging of Steel Plate	104
Air Hammer	107
Jet Airliner (500 ft. overhead)	115

Source: The Tyranny of Noise and Earth Metrics, Incorporated Noise Data Base

Standards Which Apply to Noise Sources

Noise emission standards for transportation facilities are developed and issued by the Environmental Protection Agency. Aircraft standards are regulated by the Federal Aviation Administration while trucks and train noise emission standards are enforced by the U. S. Department of Transportation.

The Environmental Protection Agency has recently proposed new noise

Typical Noise Levels (dBA) Values
Measured at 100 ft. and 1,000 ft.

115	Jet Aircraft (100 ft. distance)
105	Airplane
100	Tractor (100 ft. distance)
95	Tractor (1,000 ft. distance)
90	Tractor (100 ft. distance)
85	Tractor (1,000 ft. distance)
80	Tractor (100 ft. distance)
75	Tractor (1,000 ft. distance)
70	Tractor (100 ft. distance)
65	Tractor (1,000 ft. distance)
60	Tractor (100 ft. distance)
55	Tractor (1,000 ft. distance)
50	Tractor (100 ft. distance)
45	Tractor (1,000 ft. distance)
40	Tractor (100 ft. distance)
35	Tractor (1,000 ft. distance)
30	Tractor (100 ft. distance)
25	Tractor (1,000 ft. distance)
20	Tractor (100 ft. distance)
15	Tractor (1,000 ft. distance)
10	Tractor (100 ft. distance)
5	Tractor (1,000 ft. distance)

Source: The Bureau of Noise and Earth Effects, Environmental Noise Data Base

Standards for Noise in Urban Areas

These noise standards for transportation facilities are developed and based on the Environmental Protection Agency's noise standards and regulated by the Federal Aviation Administration while trucks and train noise emission standards are set by the U. S. Department of Transportation.

The Environmental Protection Agency has recently proposed new noise

emission limits for trucks based upon the period between 1977 through 1983. These limits effect a gradual attenuation over this period from a level of 83 dBA to 75 dBA.

New regulations are also being developed which will affect aircraft noise emissions. Certification is presently in force for certain jet aircraft which requires retrofitting to reduce their noise emission.

The Office of Noise Abatement and Control of the EPA has identified the following major goals regarding noise abatement.

1. Reduce urban noise level above 70 dBA (L_{eq}) so less than 1 million of the estimated 13 million people remain exposed to that level by 1992. (It has been determined that levels above 70 dBA (L_{eq}) are capable of causing hearing impairment).
2. Reduce urban noise level above 55 dBA ($L_{d/n}$) so less than 40 million of the estimated 100 million people remain exposed to that level by 1992. (Levels above 55 dBA ($L_{d/n}$) will cause annoyance).
3. Placement of warning labels on all equipment that would pose a threat to an operator's hearing.
4. Reduce noise levels in new public transportation equipment to 75 dBA by 1980.

In addition to the noise emission standards established by EPA, the State of California regulates noise emissions from motor vehicles. Such standards are enforced through the California Highway Patrol. The following table compares California motor vehicle operating noise

California limits for trucks based upon the period between 1975 through 1982. These limits reflect a gradual attenuation over this period from a level of 85 dB to 75 dB.

New regulations are also being developed which will reflect aircraft noise abatement. California is presently in force for certain jet aircraft which requires retrofitting to reduce their noise emission.

The Office of Noise Assessment and Control of the EPA has identified the following major goals regarding noise abatement:

1. Reduce urban noise levels above 70 dBA (L_{eq}) to less than 1 million of the estimated 12 million people reside exposed to that level by 1985. (It has been determined that levels above 70 dBA (L_{eq}) are capable of causing hearing impairment).
2. Reduce urban noise levels above 55 dBA (L_{eq}) to less than 60 million of the estimated 100 million people reside exposed to that level by 1995. (Levels above 55 dBA (L_{eq}) will cause annoyance).

3. Placement of warning labels on all equipment that would pose a threat to an operator's hearing.

4. Reduce noise levels in new public transportation equipment to 75 dB by 1985.

In addition to the noise emission standards established by EPA, the State of California requires noise emissions from motor vehicles. Such standards are enforced through the California Highway Patrol. The following table compares California motor vehicle operating noise

standards for new vehicles.

TABLE C
CALIFORNIA MOTOR VEHICLE
NOISE STANDARDS

Vehicle Type	Operating Maximum Noise Emission	New Maximum Noise Emission
Any Vehicle 6000 lbs. or more	90 dBA	86 dBA
Motorcycles	86 dBA	86 dBA
Any Other Vehicle	82 dBA	84 dBA

Standards Which Relate Land Use to Noise Levels

California law requires that the San Mateo County Airport Land Use Committee is responsible for developing a land use plan for areas directly affected by airports. The land use plan requires that areas within certain noise levels be contoured and that noise level ranges be established for each airport. The City of Foster City is affected by both San Francisco International Airport and San Carlos Airport. Table C shows the established noise level ranges in CNEL values and the general land use recommendations for various land use categories. Enforcement is handled through the local building department.

In 1974 the State of California adopted noise insulation regulations which establish uniform minimum noise insulation performance standards relating to new hotels, motels, apartments and dwellings other than detached single-family dwellings. The regulations require that where such uses are located within an annual CNEL contour of 60 from an ex-

TABLE 2

CALIFORNIA NEW VEHICLES

NOISE STANDARDS

Vehicle Type	Maximum Noise Level (dB)	Maximum Noise Level (dB)
Any Vehicle 8000 lbs. or more	85	85
Motorcycles	85	85
Any Other Vehicle	85	85

Standards which apply to new vehicles

California law requires that the San Mateo County Airport Land Use Commission is responsible for developing a land use plan for areas directly affected by aircraft. The land use plan requires that areas within certain noise levels be contained and that noise level ranges be established for each airport. The City of Foster City is affected by both San Francisco International Airport and San Carlos Airport. Table 2 shows the established noise level ranges in CRL values and the general land use recommendations for various land use categories. Enforcement is handled through the local planning department.

In 1974 the State of California adopted noise insulation regulations which establish minimum window noise insulation performance standards relating to new hotels, motels, apartments and dwellings other than detached single-family dwellings. The regulations require that such uses are located within an annual CRL contour of 65 from an ex-

**INTERIM AIRPORT LAND USE PLAN
SAN FRANCISCO AIRPORT PLAN AREA
SAN MATEO COUNTY AIRPORT LAND USE COMMISSION**

GENERALIZED LAND USE	CNEL RANGE	GENERAL LAND USE RECOMMENDATION
Residential and Educational	less than 65	Satisfactory, with little noise impact and requiring no special noise insulation requirements for new construction.
	65 to 70	New construction or development should be undertaken only after an analysis of noise reduction requirements is made and needed noise insulation features included in the design.
	greater than 70	New construction or development should not be undertaken.**
Commercial	less than 70	Satisfactory, with little noise impact and requiring no special noise insulation requirements for new construction.
	70 to 80	New construction or development should be undertaken only after an analysis of noise reduction requirements is made and needed noise insulation features included in the design.
	greater than 80	New construction or development should not be undertaken unless related to airport activities or services. Conventional construction will generally be inadequate and special noise insulation features should be included in construction.
Industrial	less than 75	Satisfactory, with little noise impact and requiring no special noise insulation requirements for new construction.
	75 to 85	New construction or development should be undertaken only after an analysis of noise reduction requirements is made and needed noise insulation features included in the design.
	greater than 85	New construction or development should not be undertaken unless related to airport activities or services. Conventional construction will generally be inadequate and special noise insulation features should be included in construction.
Open	less than 75	Satisfactory, with little noise impact and requiring no special noise insulation requirements for new construction.
	greater than 75	Land uses involving concentrations of people (spectator sports and some recreational facilities) or of animals (livestock farming and animal breeding) should generally be avoided.

** "Infill of already developed areas will be permitted. In such cases, a detailed analysis of noise reduction requirements will be made and needed noise insulation features (sufficient to reduce the intrusion of airborne noise to no greater than 45 db) will be included in the building design."

**INTERIM AIRPORT LAND USE PLAN
SAN CARLOS & HALF MOON BAY AIRPORT PLAN AREAS
SAN MATEO COUNTY AIRPORT LAND USE COMMISSION**

GENERALIZED LAND USE	CNEL RANGE	GENERAL LAND USE RECOMMENDATION
Residential and Educational	less than 55	Satisfactory, with little noise impact and requiring no special noise insulation requirements for new construction.
	55 to 60	New construction or development should be undertaken only after an analysis of noise reduction requirements is made and needed noise insulation features included in the design.
	greater than 60	New construction or development should not be undertaken.**
Commercial	less than 70	Satisfactory, with little noise impact and requiring no special noise insulation requirements for new construction.
	70 to 80	New construction or development should be undertaken only after an analysis of noise reduction requirements is made and needed noise insulation features included in the design.
	greater than 80	New construction or development should not be undertaken unless related to airport activities or services. Conventional construction will generally be inadequate and special noise insulation features should be included in construction.
Industrial	less than 75	Satisfactory, with little noise impact and requiring no special noise insulation requirements for new construction.
	75 to 85	New construction or development should be undertaken only after an analysis of noise reduction requirements is made and needed noise insulation features included in the design.
	greater than 85	New construction or development should not be undertaken unless related to airport activities or services. Conventional construction will generally be inadequate and special noise insulation features should be included in construction.
Open	less than 75	Satisfactory, with little noise impact and requiring no special noise insulation requirements for new construction.
	greater than 75	Land uses involving concentrations of people (spectator sports and some recreational facilities) or of animals (livestock farming and animal breeding) should generally be avoided.

** "Infill of already developed areas will be permitted. In such cases, a detailed analysis of noise reduction requirements will be made and needed noise insulation features (sufficient to reduce the intrusion of airborne noise to no greater than 45 db) will be included in the building design."

terior noise source then such buildings and sites shall be so designed and insulated that the maximum noise levels within any habitable rooms shall not exceed an annual CNEL of 45. These regulations have been incorporated into the Uniform Building Code and are enforced by the City building department.

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MITIGATING NOISE PROBLEMS

MITIGATING NOISE PROBLEMS

As has been previously defined a noise problem consists of three distinct components: a source, transmission path, and a receiver. To abate the noise problem, one or more of the components have to be eliminated, changed or controlled.

Control at Source

Without doubt the most ideal method of controlling noise is by reducing it at its source. For example, auto motor noise emissions could be reduced by changing the design of the source, adding a muffler or other noise attenuating device. Equipment noise could be controlled by covering the equipment in a sound reducing enclosure.

Although there are noise sources for which standards are developed by other agencies, there are certain measures which can be used by the City to control noise. For example, aircraft hardware is exempt from local control, however, case law substantiates right of local people and governments to obtain relief through operational features such as flight path, ascent angle, hours of operation and runup noise. Another example would be the use of operating restrictions on motor vehicles (speed control, truck exclusion, bus route design, etc.) as well as facility design such as signalization, surface maintenance, etc. Another measure available to the city is the use of the police power to enforce State Code regarding noisy vehicles.

CONTROLLING NOISE SOURCES

As has been previously defined a noise problem consists of three distinct components: a source, transmission path, and a receiver. To attack the noise problem, one or more of the components have to be eliminated, changed or controlled.

Control of Source

Without doubt the most ideal method of controlling noise is its reduction at the source. For example, when motor noise emissions could be reduced by changing the design of the source, adding a muffler or other noise abatement device. Equipment noise could be controlled by enclosing the equipment in a sound reducing enclosure.

Although there are noise sources for which standards are established by other agencies, there are certain measures which can be used by the City to control noise. For example, aircraft takeoffs (except from local airports), however, have few restrictions (right of takeoff and go-around) to obtain relief through residential patterns such as flight paths, aircraft angle, hours of operation and engine noise. Another example would be the use of operating restrictions on motor vehicles (speed control, truck exhaust, and noise design, etc.) as well as facility design such as signalization, surface treatments, etc. Another measure available to the city is the use of the noise power to enforce state laws regarding noisy vehicles.

Control Along Transmission Path

Noise can also be controlled by establishing noise barriers between noise sources and noise-sensitive areas. Barrier types include berms made of sloping mounds of earth, walls and fences constructed of a variety and combination of these materials. Trees and shrubs can also be used, however, they are of a very small utility in urban noise abatement since they can rarely be planted in the width necessary (about 20 meters) for noticeable noise reduction. The choice between these barrier types depends on a variety of factors including the desired level of sound attenuation, space cost, safety and aesthetics. Such barriers can provide noise attenuation of up to as much as 15 dBA.

Another method which can be used is to increase the distance or length of path between the source and receiver. This method, however, concerns a substantial amount of land and is generally not too effective.

Control at Receiver

Another alternative in controlling noise is to lessen it at the receiver. This can be accomplished by requiring the sound insulation of structures, acoustical site planning and acoustical architectural design.

The principal method used in requiring sound attenuation in construction is through the use of the building code. In communities where the building code is already administered by a well established municipal organization, additional specifications in the building code can be a convenient and inexpensive way to require acoustical construction practices such as sound insulation or sealed windows.

The arrangement of buildings on a site can be used to minimize noise impacts. If incompatible land uses already exist, or if a noise sensitive activity is planned, acoustical site planning often provides a successful technique for noise attenuation. Some techniques which can be employed to shield noise are 1) increasing the distance between the source and the receiver, 2) placing non-residential land uses such as parking lots, maintenance facilities and utility areas between the source and the receiver, 3) locating barrier-type buildings parallel to the noise source, and 4) orienting the residences away from the noise.

Noise can be controlled in a building by the use of architectural design. By giving attention to acoustical considerations in the planning of room arrangement, placement of windows, building height, balconies and courtyards, the architect may achieve significant noise impact reduction, without the need for costly acoustical construction.

Implementation

The following implementation measures are recommended for consideration relative to the establishment of a sound attenuation program for Foster City.

The Zoning regulations could be revised to contain noise provisions which would include specific noise emission standards by various land use categories. As an example, in the Industrial District, the standards for maximum emissions could be established at 70 dBA (L₁₀).

The arrangement of buildings on a site can be used to minimize noise impacts. It is recommended that buildings be placed so that the noise sensitive areas are shielded from the noise source. The following factors should be considered in the design of a site plan to minimize noise impacts: 1) the location of buildings relative to the noise source, 2) the height of buildings, 3) the distance between buildings, 4) the use of landscaping to provide a natural barrier, 5) the use of sound barriers, and 6) the use of sound absorbers. The following factors should be considered in the design of a site plan to minimize noise impacts: 1) the location of buildings relative to the noise source, 2) the height of buildings, 3) the distance between buildings, 4) the use of landscaping to provide a natural barrier, 5) the use of sound barriers, and 6) the use of sound absorbers.

It is recommended that the following factors be considered in the design of a site plan to minimize noise impacts: 1) the location of buildings relative to the noise source, 2) the height of buildings, 3) the distance between buildings, 4) the use of landscaping to provide a natural barrier, 5) the use of sound barriers, and 6) the use of sound absorbers.

Recommendations

The following recommendations are recommended for consideration relative to the establishment of a sound abatement program for Foster City.

The following recommendations could be used to control noise impacts which would include specific noise reduction standards by various land use categories. It is suggested that the following factors be considered in the design of a site plan to minimize noise impacts: 1) the location of buildings relative to the noise source, 2) the height of buildings, 3) the distance between buildings, 4) the use of landscaping to provide a natural barrier, 5) the use of sound barriers, and 6) the use of sound absorbers.

The Zoning regulations could be amended to include a special noise district which would define areas which are noise impacted and which would require that a noise study be prepared prior to site approval and development. The enforcement of such provisions could be accomplished through the architectural and Planned Development review processes.

A noise control ordinance could be adopted which would establish noise standards for source noise levels in residential, commercial, industrial and public property uses.

The requirements of the California State Code respecting acoustical review of certain types of new residential structures should be adopted by the City and such regulations should be considered for application to all types of new residential structures.

A more active program of enforcement of the California Vehicle Code regulations concerning excessive vehicle noise should be instituted by the Police Department.

The City's roadway facility program should be reviewed relative to the use of signalization, surface maintenance, equipment used in work, etc. to reduce noise impacts.

The City should diligently work towards a joint agreement with other local governments to establish a cooperative program with the Airport Committee of the City and County of San Francisco, the Federal Aviation Administration and the various airlines to help abate unnecessary noise from the San Francisco International Airport.

The zoning regulations shall be amended to include a specific noise district which would include areas which are highly impacted and which would require that a noise study or impact study be done prior to site approval and development. The enforcement of such regulations would be accomplished through the architectural and planning department review process.

A noise control ordinance shall be adopted which would establish noise standards for various noise levels in residential, commercial, industrial and public property areas.

The requirements of the California State Civil Engineering Standards Board view of certain types of new residential structures should be adopted by the City and such standards should be considered for application to all types of new residential structures.

A noise abatement program or ordinance of the California Vehicle Code regulation concerning excessive vehicle noise should be instituted by the Police Department.

The City's roadway facility program should be reviewed relative to the use of signalization, grade-separated crossings, and other measures to reduce noise impacts.

The City should actively work towards a joint agreement with other local governments to establish a regional program with the Airport Commission of the City and County of San Francisco, the Federal Aviation Administration and the various airlines to help abate unnecessary noise from the San Francisco International Airport.

Any Environmental Impact Reports prepared for either public or private projects should address noise impact and should propose feasible mitigation methods for abating or alleviating any noise activities created by such projects.

A program of public information should be instituted through the Noise Abatement Committee. Such program could include noise information to potential buyers, methods that might be used to reduce noise levels in noise impacted areas and prevent high noise levels in other areas.

any environmental impact study should be required for other units or systems
projects should address the impact and should require the same
action within the same time frame as other units and systems covered
by such projects.

A program of public information should be developed through the noise
abatement committee. Such program could include noise information to
potential buyers, advise that noise be kept to noise levels in
noise impacted areas and present noise levels in other areas.

INFORMATIONAL RESOURCES

2010-2011

INFORMATIONAL RESOURCES

A number of informational resources were obtained and used for mapping noise contours in Foster City. When possible, published information or information supplied by other agencies were used. This data was supplemented by field investigation and calculated noise levels in areas where information did not exist. The following represents a description of the resources used in the mapping process.

State Highways

CalTrans has developed contour mapping in the vicinity of all state highways. Contour maps were provided to the City from CalTrans pursuant to Section 65302 (g) of the State Code. Such maps were plotted on 1973 conditions and 1995 predicted conditions and are plotted in dBA values exceeded 10 percent of the time (L_{10}). Noise contours were based on traffic volumes existing in 1973 and predicted for 1995 demand values. Information in the Foster City area was provided for U. S. 101 and State Route 92.

Calculated Levels (L_{10})

The City Planning Department calculated L_{10} noise levels at various street locations throughout the city for both existing and predicted conditions. The calculated existing L_{10} levels were checked with various field samples to verify the validity of calculations. Calculations were also made for future levels using the same procedures. Calculations were made using procedures established in the publication

"Fundamentals and Abatement of Highway Traffic Noise". Calculations were based upon volume and average speed of traffic with adjustments for roadway gradient and barriers. Noise levels were established in contours of 5 dBA to a lower level of 55 dBA and down to 45 dBA in the vicinity of outdoor recreational areas.

San Mateo County Airport Land Use Committee

The Airport Land Use Committee of San Mateo County has prepared an Airport Land Use Plan which establishes CNEL contours within the vicinity of San Francisco International Airport and San Carlos Airport. CNEL contours are shown down to 65 CNEL for that area of Foster City covered by the San Francisco runway approach and down to 55 CNEL for that area affected by San Carlos Airport.

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